National Advisory Committee for Aeronautics

Research Abstracts

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CURRENT NACA REPORTS

NACA Rept. 1187

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF ADDITIVE DRAG. Merwin Sibulkin. 1954. ii, 12p. diagrs. (NACA Rept. 1187. Formerly RM E51B13)

The significance of additive drag is discussed and equations for determining its approximate value are derived. Charts are presented giving values of additive drag for open-nose inlets and for annular-nose inlets with conical flow at the inlet. The effects of variable inlet total-pressure recovery and static pressures on the center body are investigated, and an analytical method of predicting the variation of pressure on the center body with mass-flow ratio is given. Experimental values of additive drag are compared with values predicted by the methods presented.

NACA RM L55E09a

SUMMARY OF RECENT THEORETICAL AND EXPERIMENTAL WORK ON BOX-BEAM VIBRATIONS. John M. Hedgepeth. June 1955. 10p. diagrs., photo., 2 tabs. (NACA RM L55E09a)

A discussion of various secondary effects which have an important influence on the vibration characteristics of box beams is presented. Means of incorporating these effects in vibration analyses of actual built-up box beams are discussed. Comparisons with experiment are given; good agreement between theory and experiment is obtained when the secondary effects are included.

NACA RM L55E11b

PRELIMINARY INVESTIGATION OF THE COMPRESSIVE STRENGTH AND CREEP LIFETIME OF 2024-T3 (FORMERLY 24S-T3) ALUMINUM-ALLOY PLATES AT ELEVATED TEMPERATURES. Eldon E. Mathauser and William D. Deveikis. June 1955. 12p. diagrs. (NACA RM L55E11b)

The results of elevated-temperature compressive strength and creep tests of 2024-T3 (formerly 24S-T3) aluminum-alloy plates supported in V-grooves are presented. A relation previously developed for predicting plate compressive strength at room temperature was satisfactory for determining elevated temperature strength. Creep-lifetime results are presented for the plates in the form of master creep-lifetime curves using a time temperature parameter. A comparison is made between tensile and compressive creep lifetime for the plates, and the magnitude by which the design stress is decreased because of material creep and loss of strength due to exposure at elevated temperatures is indicated.

NACA RM L55E12b

TENSILE PROPERTIES OF SOME SHEET MATERIALS UNDER RAPID-HEATING CONDITIONS. George J. Heimerl and John E. Inge. June 1955. 10p. diagrs. (NACA RM L55E12b)

Results are presented of tests to determine the effect of heating at uniform temperature rates from 0.2° F to 100° F per second on the tensile properties of some sheet materials under constant load conditions - 7075-T6 (75S-T6) and 2024-T3 (24S-T3) aluminum alloys, Inconel, and RS-120 titanium alloy. Some comparisons are given between yield and rupture stresses obtained under rapid-heating conditions and those obtained from elevated-temperature stress-strain tests for 1/2-hour exposure. Master yield- and rupture-stress curves based on the use of a linear temperature-rate parameter are included which provide a convenient method for predicting yield and rupture stresses and temperatures for different temperature rates.

NACA TM 1341

APPROXIMATE HYDRODYNAMIC DESIGN OF A FINITE SPAN HYDROFOIL. (Priblizhennyi gidrodinamicheskii raschet podvodnogo kryla konechnogo razmakha). A. N. Vladimirov. June 1955. 68p. diagrs., 5 tabs. (NACA TM 1341. Trans. from Central Aero-Hydrodynamical Institute, Rept. 311, 1937).

Previous work on the motion of various bodies under the surface of a heavy fluid is discussed. The solution of the motion of a flat plate by Keldysh and Lavrentiev is applied to the motion of a hydrofoil, making possible the presentation of charts for determining the lift and resistance of an infinite span hydrofoil operating in a heavy frictionless fluid having infinite depth below the free water surface. Consideration is given to the effects of viscosity and a method is suggested to correct for the finite span. The effect of the water surface on the downwash behind the foil is also discussed. A comparison of theoretical results obtained from this work with experimental data indicates that a basis for the approximate hydrodynamic design of a finite span hydrofoil has been achieved.

NACA TN 3378

ACOUSTICAL TREATMENT FOR THE NACA 8- BY 6-FOOT SUPERSONIC PROPULSION WIND TUNNEL. Leo L. Beranek, Samuel Labate and Uno Ingard, Bolt Beranek and Newman, Inc. June 1955. 86p. diagrs., photo., 7 tabs. (NACA TN 3378)

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This report summarizes the results of a project at the Lewis Flight Propulsion Laboratory to silence the 8- by 6-foot supersonic wind tunnel. Sound measurements in the neighborhood surrounding the tunnel were conducted to evaluate the noise-attenuation requirements. A muffler-development program was continued until these attenuations were achieved. The final design for the acoustic treatment is described and experimental performance curves are compared with anticipated theoretical results.

NACA TN 3382

EXPERIMENTS WITH A ROTATING-CYLINDER VISCOMETER AT HIGH SHEAR RATES. J. A. Cole, R. E. Petersen and H. W. Emmons, Harvard University. June 1955. 31p. diagrs., tab. (NACA TN 3382)

Two straight mineral oils and a polymer-containing oil have been tested in a rotating-cylinder viscometer at high shear rates (maximum 0.25 million reciprocal seconds) and the accompanying heat effects have been investigated. The torque measurements are of low accuracy and fail to establish the moderately non-Newtonian behavior of the polymer-containing oil, but the temperature measurements, which are in good agreement with a thermal analysis, do indicate the presence of temporary viscosity decrease at high shear rates for this oil.

NACA TN 3411

PRESSURE WAVES GENERATED BY ADDITION OF HEAT IN A GASEOUS MEDIUM. Boa-Teh Chu, Johns Hopkins University. June 1955. 47p. diagrs. (NACA TN 3411)

The approximate formula of a linearized solution for the pressure field generated by a moderate rate of heat release is given. The analogies between the pressure waves generated by heat release and those generated by (1) mass release, (2) piston motion, or (3) a two-dimensional body in a supersonic stream are established analytically. The exact solution of an idealized problem in which heat is released uniformly at a section of tube with a given rate, large or small, is also constructed. The corresponding problems in three dimensions are also solved. Some applications of the theory are given.

NACA TN 3412

CREEP AND CREEP-RUPTURE CHARACTERISTICS OF SOME RIVETED AND SPOT-WELDED LAP JOINTS OF AIRCRAFT MATERIALS. Leonard Mordfin, National Bureau of Standards. June 1955. 53p. diagrs., photos., 6 tabs. (NACA TN 3412)

Equipment, test techniques, and results are presented for an experimental investigation of the creep of lap joints. Riveted aluminum-alloy joints fabricated from 75S-T6 and 24S-T3 sheet with 24S and 24S-T31 rivets were tested at 300°, 400°, and 500° F. Spot-welded joints of 1/4-hard, type 301 stainless steel were tested at 800° F. Each type of joint was also tested in tension at room temperature.

NACA TN 3416

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EFFECT OF TUNNEL WALLS ON THE FORCES ON AN OSCILLATING AIRFOIL IN TWO-DIMENSIONAL SUBSONIC COMPRESSIBLE FLOW. Harry L. Runyan, Donald S. Woolston and A. Gerald Rainey. June 1955. 41p. diagrs., photo. (NACA TN 3416)

The integral equation defining the problem of an oscillating wing in a tunnel is treated and is presented in a form adapted to calculations. Application is made to a number of examples to illustrate the influence on the magnitude of wall effects of variations in frequency, Mach number, and ratio of tunnel height to wing semichord. Comparison is made with experimental measurements for several subsonic Mach numbers.

NACA TN 3448

THEORETICAL ANALYSIS OF INCOMPRESSIBLE FLOW THROUGH A RADIAL-INLET CENTRIFUGAL IMPELLER AT VARIOUS WEIGHT FLOWS. I - SOLUTION BY A MATRIX METHOD AND COMPARISON WITH AN APPROXIMATE METHOD. Vasily D. Prian, James J. Kramer and Chung-Hua Wu. June 1955. 39p. diagrs., tab. (NACA TN 3448)

A method for the solution of the incompressible, nonviscous flow through a centrifugal impeller, including the inlet region, is presented. Several numerical solutions are obtained for four weight flows through an impeller at one operating speed. The results are presented in a series of figures showing streamlines and resultant velocity contours. A comparison is made with the results obtained by use of a rapid approximate method of analysis.

NACA TN 3449

THEORETICAL ANALYSIS OF INCOMPRESSIBLE FLOW THROUGH A RADIAL-INLET CENTRIFUGAL IMPELLER AT VARIOUS WEIGHT FLOWS. II - SOLUTION IN LEADING-EDGE REGION BY RELAXATION METHODS. James J. Kramer. June 1955. 19p. diagrs. (NACA TN 3449)

The detailed solution of the flow around the blade nose of a 48-inch-diameter radial-inlet centrifugal impeller has been obtained by relaxation methods for four weight flows. The results are presented in a series of figures showing streamlines and relative velocity contours. Minimum velocity gradients around the blade nose occurred for the weight flow corresponding to a mean angle of attack of -4.6° computed from blade speed and an upstream axial-radial velocity for which blade blockage has been taken into account. A small positive local angle of attack seems desirable for blades with rounded leading edges.

NACA TN 3457

ESTIMATION OF INLET LIP FORCES AT SUBSONIC AND SUPERSONIC SPEEDS. W. E. Moeckel. June 1955. 12p. diagrs. (NACA TN 3457)

The effects of inlet lip thickness on inlet performance are estimated as functions of mass flow for subsonic and supersonic flight speeds. At subsonic speeds, pressure-recovery losses and additive drag are shown to decrease linearly with increasing lip frontal area if the maximum suction force is attained. At supersonic speeds, inlet drag increases linearly with inlet lip frontal area at full mass flow. For reduced mass flow, some reduction in additive drag is possible with lips of moderate thickness, but the magnitude of this reduction becomes negligible as flight speed increases.

NACA TN 3461

TURBULENT-HEAT-TRANSFER MEASUREMENTS AT A MACH NUMBER OF 1.62. Maurice J. Brevoort and Bernard Rashis. June 1955. 15p. diagrs., tab. (NACA TN 3461)

An axialty symmetric annular nozzle was used to obtain essentially flat-plate results for turbulent-heat-transfer coefficients and temperature-recovery factors. The test results are for a Mach number of 1.62 and for a Reynolds number range of 7.22×10^5 to 1.20×10^8. The heat-transfer-coefficient results agree with theoretical results for $M = 1.60$ and $T_w/T_\infty = 1.60$. The recovery factors are on the average 1.5 percent lower than data for a Mach number of 2.4.

NACA TN 3499

CALCULATION OF THE SUPERSONIC PRESSURE DISTRIBUTION ON A SINGLE-CURVED TAPERED WING IN REGIONS NOT INFLUENCED BY THE ROOT OR TIP. Walter G. Vincenti and Newman H. Fisher, Jr. June 1955. 32p. diagrs. (NACA TN 3499)

The shock-expansion method for the calculation of the pressures on cylindrical wings in supersonic flow is extended to tapered wings made up of single-curved surfaces. The method applies in regions where (a) the component of velocity normal to the surface rulings is supersonic and (b) the flow is not influenced by tips or junctures. In these regions the flow is defined by a pair of ordinary differential equations whose solution is readily obtained by numerical means. Results are shown and discussed for a representative triangular wing.

NACA TN 3502

THE TRANSONIC CHARACTERISTICS OF 38 CAMBERED RECTANGULAR WINGS OF VARYING ASPECT RATIO AND THICKNESS AS DETERMINED BY THE TRANSONIC-BUMP TECHNIQUE. Warren H. Nelson and Walter J. Krumm. June 1955. 173p. diagrs., photos. (NACA TN 3502. Formerly RM A52D11)

An investigation was made in the Ames 16-foot high-speed wind tunnel utilizing the transonic-bump technique to determine the aerodynamic characteristics at transonic Mach numbers of 38 cambered rectangular wings. The wings had aspect ratios of 4, 3, 2, 1.5, and 1, and NACA 63A2XX and 63A4XX sections with thickness-to-chord ratios of 10, 8, 6, 4, and 2 percent. The Mach number range was 0.6 to 1.12 with corresponding Reynolds numbers of 1.7 to 2.2 million. The data are presented without analysis.

BRITISH REPORTS

N-36887*

Aeroplane and Armament Experimental Establishment (Gt. Brit.) DETERMINATION OF THE VARIATION WITH ALTITUDE OF THE RECOVERY FACTOR OF AIR THERMOMETERS. December 17, 1954. 28p. diagrs., photos., 10 tabs. (AAEE/Tech/111)

Tests were made for the standard knife edge and two other available air thermometer bulbs. The results show a significant decrement with attitude in the value of the recovery factor of the order of 0.2 between 5,000 and 40,000 feet. That means a change from 0.69 to 0.51 in the values for the standard knife edge bulb. In view of these findings, it appears imperative in performance tests which are sensitive to ambient air temperature, to determine the recovery factor of the outside air thermometer over the altitude range of the aircraft. Alternatively, there is a need for an air thermometer whose recovery factor remains constant with change of attitude.

N-36890*

Royal Aircraft Establishment (Gt. Brit.) THE TORSIONAL VIBRATIONS OF A CLASS OF THIN, TAPERED, SOLID WINGS. Elizabeth A. Frost. January 1955. 22p. diagrs., tab. (RAE Tech. Note Structures 152)

This report considers the torsional vibrations of thin solid wings of doubly symmetrical chordwise section, with linear variation of chord and parabolic variation of thickness. Frequencies of symmetrical and antisymmetrical vibrations are presented graphically for a range of values of the aspect ratio and the taper ratio.

N-36902*

Royal Aircraft Establishment (Gt. Brit.) TESTS ON THE PROTECTION GIVEN TO METALS BY ETCH PRIMERS. H. G. Cole. January 1955. 13p. 6 tabs. (RAE Tech. Note Met. 209)

Long term seawater spray corrosion tests have shown that the relative performance of painting schemes based on six commercial etch primers varied markedly from metal to metal. On zinc and cadmium-plated steel, the etch primer schemes gave better performance than conventional paints applied over classical methods of surface treatment. On steel and aluminum alloys, the use of etch primers is an acceptable substitute for conventional methods of protection, provided that the etch primer is followed by a full protective scheme. Their use on magnesium alloys is risky because of the danger of attack on the metal.

N-36905*

Royal Aircraft Establishment (Gt. Brit.) A JUNCTION TRANSISTOR DECADE COUNTER. H. W. P. Knapp. January 1955. 11p. diagrs., photo. (RAE Tech. Note GW 354)

A junction transistor decade counter is described which is tolerant of supply voltage, input amplitude, and ambient temperature variations.

DECLASSIFIED NACA REPORTS

NACA RM A52G17

THE USE OF LEADING-EDGE AREA SUCTION TO INCREASE THE MAXIMUM LIFT COEFFICIENT OF A 35° SWEPT-BACK WING. Curt A. Holzhauser and Robert K. Martin. September 1952. 37p. diagrs., photo., 3 tabs. (NACA RM A52G17) (Declassified from Confidential, 6/10/55)

Measurements were made of the increase in lift coefficient obtained with various amounts of area suction. Flow coefficients and power inputs required to obtain these lift coefficients were measured at free-stream velocities from 112 to 180 feet per second. With full-span area suction and a maximum chordwise opening of 2.2 percent, the $C_{L_{max}}$ of the model with flaps deflected was increased from 1.33 to 2.00 with a flow coefficient of 0.00108 and a suction horsepower of 47 at a free-stream velocity of 129 feet per second. There appeared to be no unacceptable characteristics that a 35° swept-wing airplane would exhibit in low-speed flight as a result of employing area suction.

NACA RM L7F30

FREE-FLIGHT INVESTIGATION OF CONTROL EFFECTIVENESS OF FULL-SPAN, 0.2-CHORD PLAIN AILERONS AT HIGH SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS TO DETERMINE SOME EFFECTS OF WING SWEEPBACK, TAPER, ASPECT RATIO, AND SECTION-THICKNESS RATIO. Carl A. Sandahl. August 13, 1947. 16p. diagrs., photos., tab. (NACA RM L7F30) (Declassified from Confidential, 6/10/55)

The aileron control characteristics of untapered, 45° sweptback wings of aspect ratio 3 were found to be generally the same for the 65-006 and 65-009 sections. The tapered 45° sweptback wings of aspect ratio 3 and 65-009 section exhibited a small abrupt change in rolling effectiveness from M = 0.92 to 1.00 which was not characteristic of untapered wings tested having the same sweep, aspect ratio, and section. A reduction in aspect ratio from 3 to 1.75 for unswept, untapered wings gave an increase in rolling effectiveness. Both aspect-ratio configurations showed undesirable control characteristics at transonic speeds.

NACA RM L51F11

RECENT EXPERIMENTAL FLUTTER STUDIES. Arthur A. Regier and Dennis J. Martin. June 12, 1951. 18p. diagrs. (NACA RM L51F11) (Declassified from Confidential, 6/10/55)

This paper presents in a rather brief fashion some of the highlights of recent experimental flutter studies. Material from several papers is brought together and compared. The material includes trend studies of flutter of swept and unswept wings at transonic speeds; studies of a bending-type flutter of swept wings; flutter involving body modes; and preliminary studies of M and W and delta wing configurations.

NACA RM L51L03

PRESSURE DISTRIBUTIONS AT MACH NUMBERS FROM 0.6 TO 1.9 MEASURED IN FREE FLIGHT ON A PARABOLIC BODY OF REVOLUTION WITH SHARPLY CONVERGENT AFTERBODY. William E. Stoney, Jr. April 1952. 34p. diagrs., photos. (NACA RM L51L03) (Declassified from Confidential, 6/10/55)

A flight test was made, at Mach numbers from 0.6 to 1.9, of a fin-stabilized parabolic body of revolution having a sharply convergent afterbody. Pressures were measured at eight longitudinal stations on the body and on the base with and without a simulated wind-tunnel sting extending from the base of the model. The results were compared with theoretical determinations of the pressures by linear and exact methods.

NACA RM L52L05

WIND-TUNNEL INVESTIGATION OF STALL CONTROL BY SUCTION THROUGH A POROUS LEADING EDGE ON A 37° SWEPTBACK WING OF ASPECT RATIO 6 AT REYNOLDS NUMBERS FROM 2.50×10^6 to 8.10×10^6. Robert R. Graham and William A. Jacques. March 1953. 67p. diagrs., photo., 2 tabs. (NACA RM L52L05) (Declassified from Confidential, 6/10/55)

Stall control by suction through a porous leading-edge upper surface was investigated on a plain wing and on the same wing with half-span split or double slotted flaps. Some effects of varying the chordwise and spanwise extent of porosity and varying the flow coefficient were investigated on the plain wing. Force and moment data are presented along with minimum measured leading-edge pressure coefficients across the span of the wing.

NACA RM L53C02

THE BASE PRESSURE AT SUPERSONIC SPEEDS ON TWO-DIMENSIONAL AIRFOILS AND BODIES OF REVOLUTION (WITH AND WITHOUT FINS) HAVING TURBULENT BOUNDARY LAYERS. Eugene S. Love. April 1953. 65p. diagrs., photos. (NACA RM L53C02) (Declassified from Confidential, 6/10/55)

An analysis is made of available experimental data to show the effect of most of the variables that are more predominant in determining base pressure at supersonic speeds. The analysis is restricted to turbulent boundary layers and covers two-dimensional bases and the bases of bodies of revolution, with and without stabilizing fins. An analogy to the pressure rise required to separate the boundary layer is presented as are simple semiempirical methods for the estimation of base pressure.

NACA RM L53F15a

STUDIES OF THE SPEED STABILITY OF A TANDEM HELICOPTER IN FORWARD FLIGHT. Robert J. Tapscott and Kenneth B. Amer. August 1953. 35p. diagrs., photos., tab. (NACA RM L53F15a) (Declassified from Confidential, 6/10/55)

Analytical and experimental studies and corresponding pilots' opinions of the speed stability of a tandem helicopter are presented and means for improving the speed stability are discussed. An analytical expression is derived for use in predicting changes in speed stability of a tandem helicopter brought about by changes in the rotor geometry. Constants for use with the analytical expression are presented in chart form.

NACA RM L53G15a

THE VARIATION OF ATMOSPHERIC TURBULENCE WITH ALTITUDE AND ITS EFFECT ON AIRPLANE GUST LOADS. Robert L. McDougal, Thomas L. Coleman and Philip L. Smith. November 1953. 16p. diagrs., 2 tabs. (NACA RM L53G15a) (Declassified from Confidential, 6/10/55)

Analysis of turbulence data for altitudes up to 60,000 feet indicates substantial reductions in the amount and relative intensity of the turbulence at the higher altitudes. The implications of these reductions in the turbulence are discussed in regard to the gust loads for assumed airplane operations.

NACA RM L54B16b

FLIGHT TESTS OF A 0.4-SCALE MODEL OF A STAND-ON TYPE OF VERTICALLY RISING AIRCRAFT. Marion O. McKinney and Lysle P. Parlett. March 1954. 23p. diagrs., photos. (NACA RM L54B16b) (Declassified from Confidential, 6/10/55)

The results of a free-flight investigation of the stability and control of a 0.4-scale model of a stand-on type of vertically rising aircraft in take-offs and landings and in hovering and forward flight are presented. The aircraft component of the model consisted of a motor-driven, single-rotation propeller in a short shroud with antitorque vanes and control surfaces at the rear of the shroud.

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